



Prevalence of Pathogenic *Aspergillus* species in Atmosphere During Ten Years (2011-2021) in Kathmandu, Nepal

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Introduction

- Fungal spores in the atmosphere change with meteorological factors, air pollution and probably climate heating.
- *Aspergillus* species, pathogenic and some allergenic fungi, are ubiquitously found in the environment.
- Inhalation of *Aspergillus* conidia lead to invasive disease in immunocompromised individuals.
- *Aspergillus fumigatus* is a major cause of life threatening invasive aspergillosis (IA) that mostly occurs in immunocompromised patients.
- Other infections caused by *Aspergillus* species are chronic pulmonary aspergillosis (CPA), allergic bronchopulmonary aspergillosis (ABPA) and severe asthma with fungal sensitization (SAFS).
- Airborne pathogenic fungi including *Aspergillus* species are prevalent in Kathmandu city and *Aspergillus* diseases have also been reported frequently.
- We described the prevalence of pathogenic *Aspergillus* species in the atmosphere of monument zones during ten years (2011-2021) in Kathmandu, Nepal.

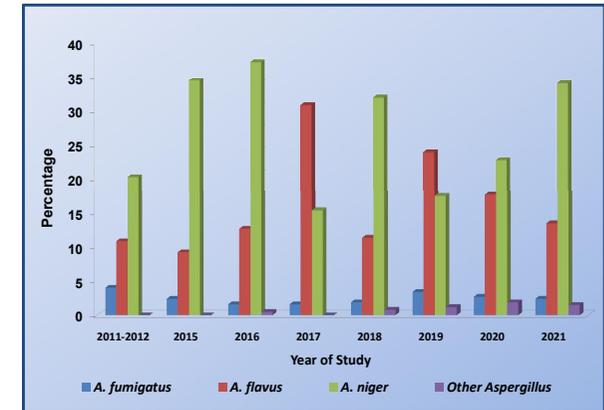
Materials and Methods

- Airborne fungal conidia were collected using a gravity plate method in monument zones of Kathmandu city between January 2018-October 2021.
- Two sets of duplicate sabouraud dextrose agar (SDA) plates with chloramphenicol (50 mg/L) were exposed in selected locations on seasonal basis and diurnal variations.
- The exposed agar plates were incubated, one at 28°C for total airborne fungal count (nonpathogenic fungi) and another at 37°C for pathogenic airborne fungal count, for up to 3-7 days and examined daily for any visible growth of fungi.

- The different types of fungi including pathogenic *Aspergillus* species were enumerated and identified to species complex level by macroscopic and microscopic characteristics.
- The composition and concentration of pathogenic *Aspergillus* conidia in the atmosphere were compared with the data reported from same locations of Kathmandu between 2011-2017.

Results

- From the atmosphere, 35,015 fungal colonies and 11,975 pathogenic fungal colonies were isolated during January 2018-October 2021.
- The maximum pathogenic airborne fungal count was recorded in Spring 2021, whereas the minimum pathogenic airborne fungal count was recorded in Winter 2018.
- More than 29 different fungal species complexes belonging to 24 fungal genera were identified.
- Most prevalent airborne pathogenic fungi were the genus *Aspergillus* that accounted for 46.0%, 45.8%, 44.9% and 51.3% in the year 2018, 2019, 2020 and 2021 respectively.
- During the study period, distribution of pathogenic *Aspergillus* species was *A. fumigatus* (2.6%), *A. flavus* (16.0%), *A. niger* (27.8%) and other *Aspergillus* (1.4%).
- The pathogenic *Aspergillus* conidia in the atmosphere reached their peaks in the afternoon.
- The highest and lowest concentrations of pathogenic *Aspergillus* were recovered in Spring and Winter seasons respectively.
- The prevalence of pathogenic *Aspergillus* species was recorded as 35% during 2011-2012, 46% during June-September 2015, 52% in 2016 and 48% in 2017.
- When the pathogenic *Aspergillus* burden in the atmosphere was compared during ten years of the study period, the maximum concentration was recorded in the year 2016.



NB: The species name of genus *Aspergillus* represents "species complex" for that species.

Figure: Prevalence of Pathogenic *Aspergillus* species in atmosphere in Kathmandu, Nepal (2011-2021)

Conclusions

- The pathogenic and allergenic *Aspergillus* species were prevalent in the atmosphere of Kathmandu city.
- The existence of high concentrations of airborne pathogenic *Aspergillus* conidia pose a greater risk of opportunistic invasive fungal infections and allergenic responses in immunocompromised individuals.
- This study indicates the prevailing situation of aeromycoflora that will be useful in prevention and control of airborne fungal diseases and implementation of measures to reduce environmental pollution.

Acknowledgements

We thank Atmaz Kumar Shrestha and Prashanna Maharjan for their help during collection of samples.

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